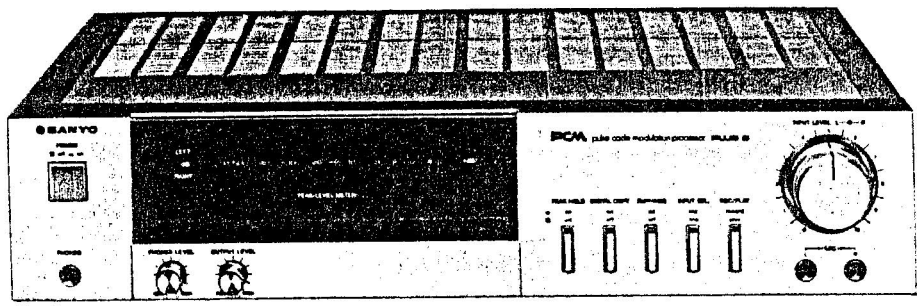
SERVICE MANUAL

PLUSE CODE PROCCESSOR MODULATION

SANYO

PLUS 5



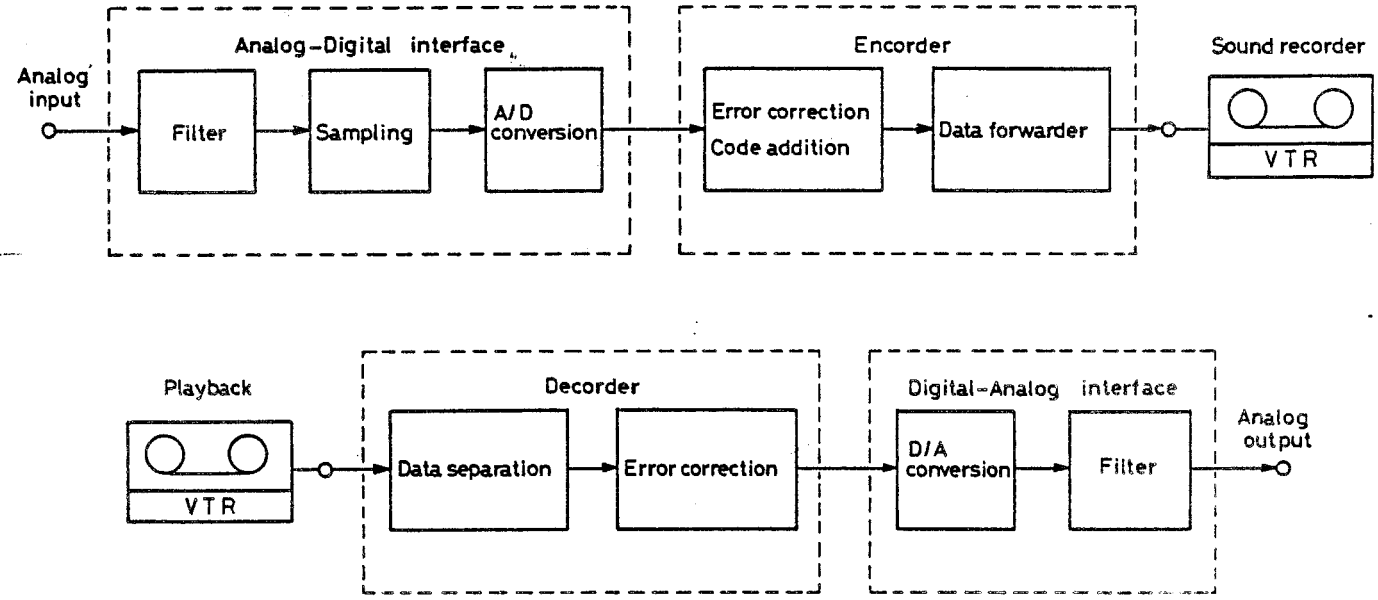
SPECIFICATIONS

Signal system	NTSC, PAL/SECAM		
Encoding system	EIAJ standard format		
Number of audio channels	2 channels		
Sampling frequency	44.056 kHz (NTSC), 44.100 kHz (PAL/SECAM)		
Sample format	14 bit equivalence (12 bit 3 broken lines)		
Frequency response	10Hz – 20kHz (+0.5/–0.8 dB)		
Distortion ratio	0.03%		
Dynamic range	86 dB		
Wow, flutter	Immeasurably small		
Error correction system	CRCC, 2 parity-codes and interpolation		
Crosstalk	70 dB and above (10 kHz)		
Input terminals	LINE IN:	Sensitivity	142mV
		Input impedance	47 kΩ
	MIC:	Sensitivity	1 mV
		Input impedance	10 kΩ
	VIDEO IN:	Standard input level	1.7 Vp-p
		Input impedance	75Ω
Output terminals	LINE OUT:	Output level	2 V (variable)
		Output impedance	less than 5 kΩ
	VIDEO OUT:	Standard output level	1 Vp-p
		Output impedance	75 ohm
	PHONES:	Output level (unloaded)	2 V (variable)
		Output impedance	100 ohm
		Headphones impedance	8 Ω – 10 kΩ
Power	AC: 120/220/240 V, 50/60 Hz		
Power consumption	40 W		
Dimensions	Approx. 440 (W) x 270 (D) x 100 (H) mm		
Weight	Approx. 5 kg		

* Improvements in specifications and design may be made without notice.

COMPOSITION OF PCM RECORDER

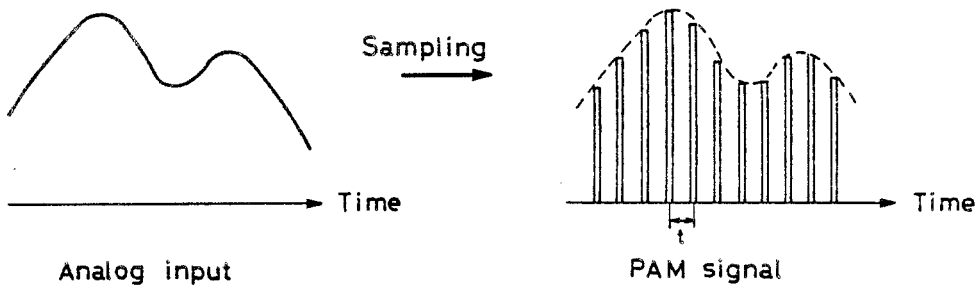
This PCM recorder for video cassette recorder systems can be roughly divided into four main sections, as shown in Fig. 1-1.



(Fig. 1-1)

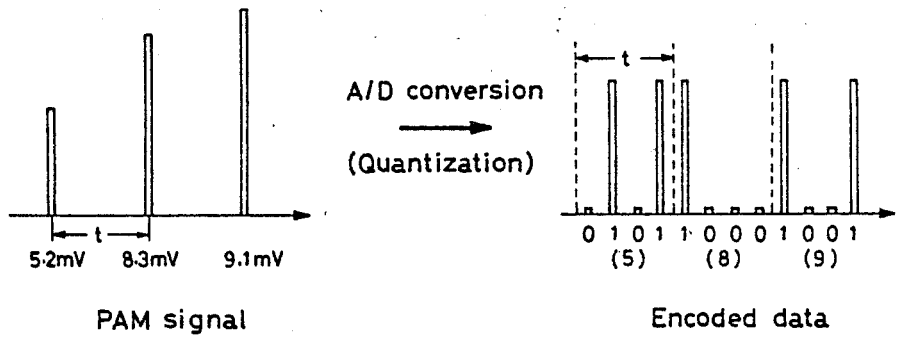
(1) Encoder section

In order to remove unnecessary frequency component and noise included in the input analog signal, the signal is passed through a filter which passes only signals with frequencies less than 20 kHz. This process must be performed before sampling, which is the next process the analog signal undergoes. Sampling is an operation in which a continuous analog waveform is read for a fixed time interval t. By this process the analog waveform is segmented into intervals of time t as is shown in Fig. 1-2. This signal is called a PAM (pulse amplitude modulation) wave.



(Fig. 1-2)

Next, in order to convert this PAM wave (still an analog signal) into a digital signal, it is passed through an A/D (analog to digital) converter, so that, as shown in Fig. 1-3, the pulse heights (analog values) are put into digital form and binary pulses are output.
By these 3 processes a single digit (Example shows binary, 4-place digits.) for every t interval is output.



(Fig. 1-3)

(2) Code recording section

A correction code is added to the data which has been converted to digital form. By means of this correction code, even parts of the signal that have been lost due to scratches and foreign matter on the tape can be accurately restored to the original signal. In the data forwarder section, which is the last section, the data together with the above-mentioned correction code is sent on a television signal to the video cassette recorder.

(3) Code playback section

To begin with, only the necessary digital data is isolated from the reproduced TV signal. Next, the error correction code is utilized to correct any errors in the reproduced data and restore the correct data.

(4) Decoder section

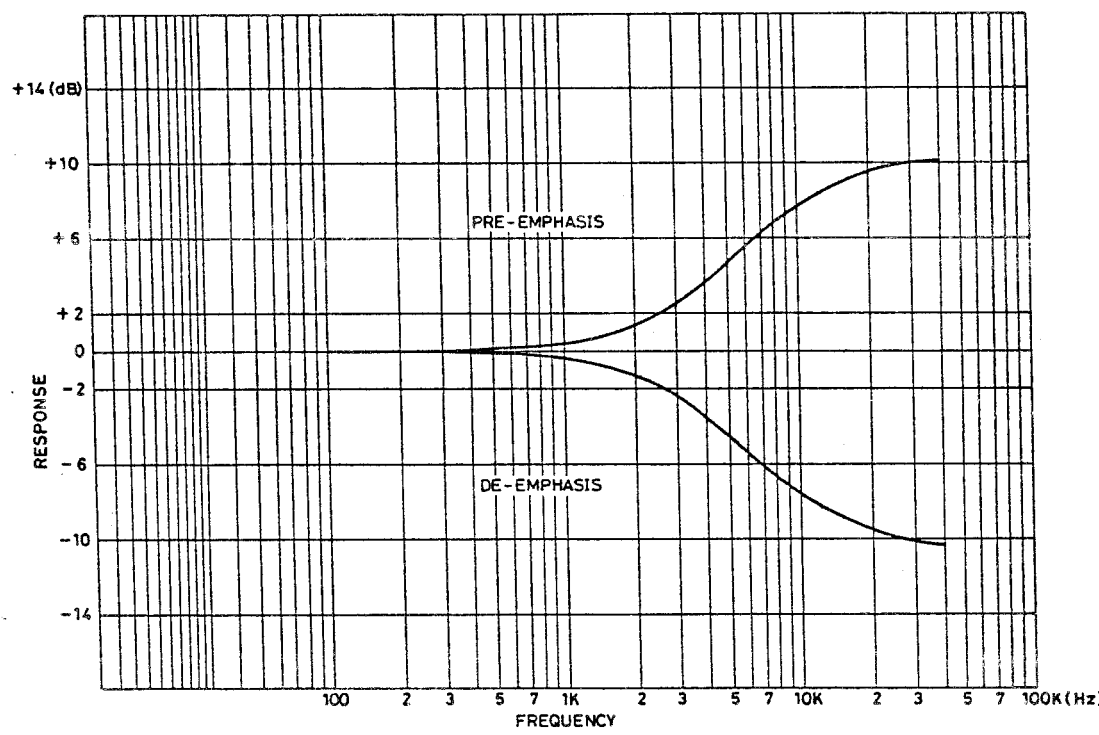
In this section the binary-coded pulse code is returned to a PAM wave by means of a D/A (digital to analog) converter. And then it is returned to the original smooth analog signal by passing it through a filter which passes only signals with frequencies less than 20 kHz.

- Refer to the block diagrams while studying this operation.

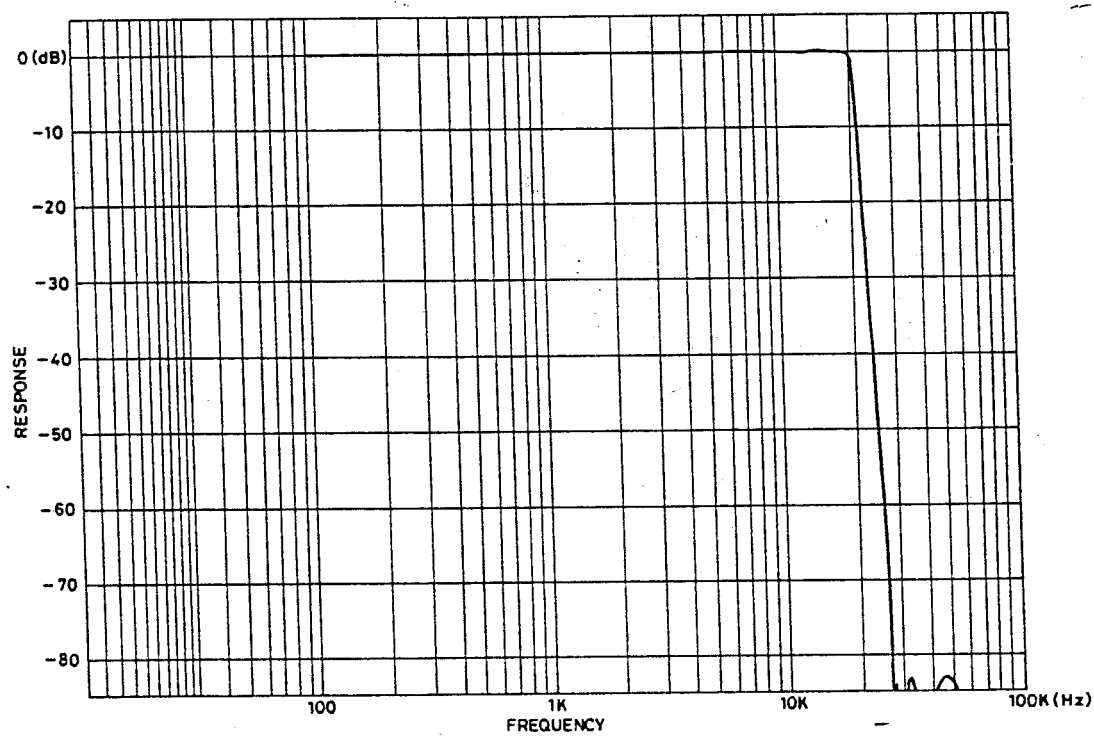
1. Operation of the Recording System

1-1 The analog signal input to the LINE IN (or MIC) terminal is input to the pre-emphasis circuit by means of the INPUT LEVEL control and is amplified and emphasized. After this it passes through an analog switch (IC342) and a buffer amplifier and is limited to 20 kHz in a low-pass filter (IC343, IC443), after which it is input to a sample-and-hold circuit (IC1, 2) by means of a flat amplifier for signal amplification. Furthermore, in order to obtain a monitor output during recording, the output signal from the low-pass filter is also input to the de-emphasis circuit, given a flat frequency characteristic, and output from the LINE OUT terminal.
The characteristics of the pre-emphasis and de-emphasis circuits are shown in Fig. 2-1.
The low-pass filter prevents fold-back noise by obtaining an attenuation characteristic as that shown in Fig. 2-2 for the upper one-half of the sampling frequency (44.056 kHz) band.

* Fold-back noise
This is a phenomenon which occurs when the upper one-half of the sampling frequency (44.056 kHz) is contained in the input frequency, which causes a playback signal of the same level to also be generated in the audible lower one-half of the sampling frequency.

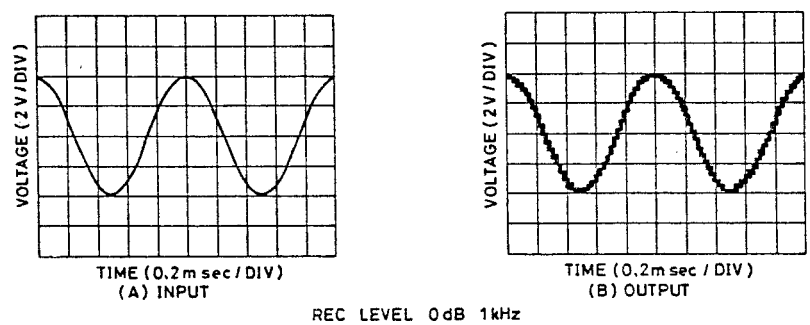


(Fig. 2-1)



(Fig. 2-2)

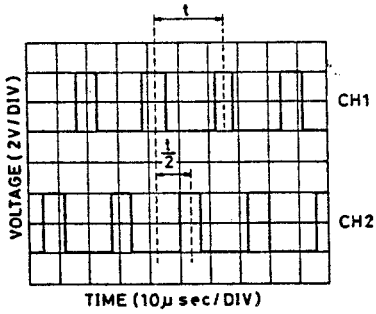
1-2 The signal input to the sample-and-hold circuit is sampled for a designated period of time, and these values are held until A/D conversion in the next step is completed. Fig. 2-3(A) shows the input waveform entering (pin (3) of IC1, 2) the sample-and-hold circuit, and Fig. 2-3(B) shows the output waveform leaving (pin (5) of IC1, 2) the circuit.



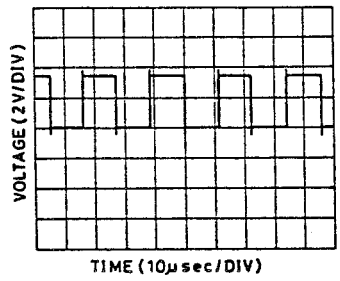
(Fig. 2-3)

Fig. 2-4 shows the control signal waveform (pin (8) of IC1, 2) for sampling, and because this system is a time-division multiplex, the timing for sampling of the left and right channels is shifted only 1/2 t (where t is the sampling interval and 1/2 t equals 1/t of the sampling frequency).

Fig. 2-5 shows the control signal waveform (pin (10) of IC5) of the analog switch (IC5), which is used in time-division multiplexing.



(Fig. 2-4)

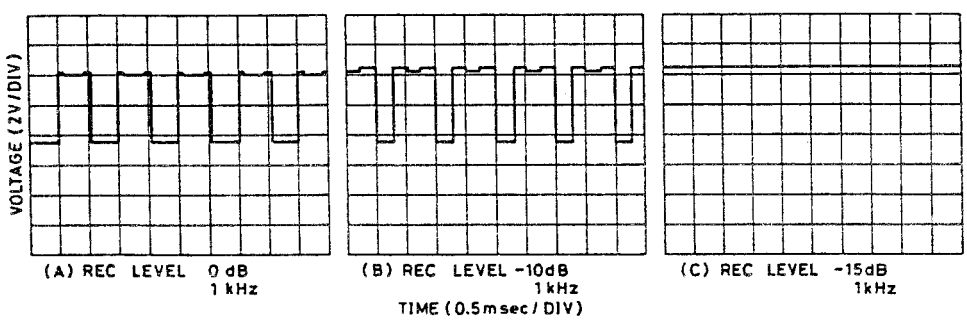


(Fig. 2-5)

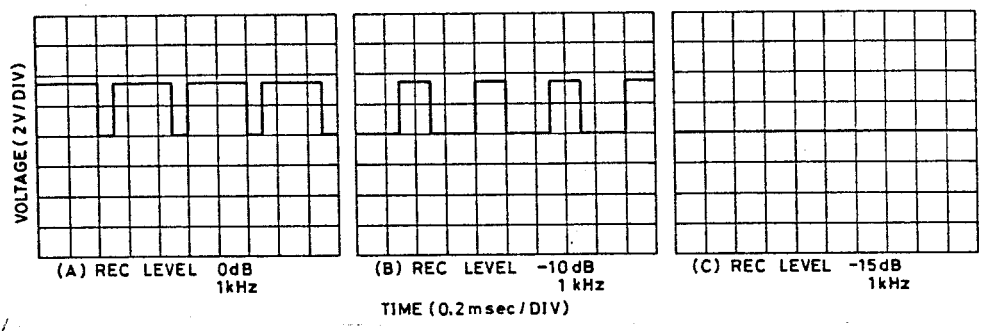
* Time-division multiplex recording system
This is a system which alternately records the signals from the left and right channels with respect to a time axis. The switching is arranged so that, in response to a clock signal, the signal for the right channel is only passed at odd times and the signal for the left channel is only passed at even times.

1-3 The signal (PAM wave) multiplexed according to time sharing is input to the A/D converter (IC10) and converted to a digital signal.
In this unit a system has been adopted which obtains a 14-bit dynamic range by using a 12-bit A/D converter to perform three-open-line quantization. In order to perform this, the sample-and-hold output voltage is detected, and a comparator (IC3) which sends the signal to the digital section and a buffer amplifier (IC6) which compresses the output level after time sharing are provided.
Fig. 2-6 shows the comparator signal waveforms (pins (1), (2) or (13), and (14) of IC3) corresponding to each input level, and Fig. 2-7 shows the control signal waveforms (pin (9) of IC8) of the analog switch output from the digital section in order to switch the buffer amplifier ranges.

* Open-line quantization
This is a system which varies the quantization steps in response to the amplitude with respect to a quantization step with constant linear quantization in order to expand the dynamic range.

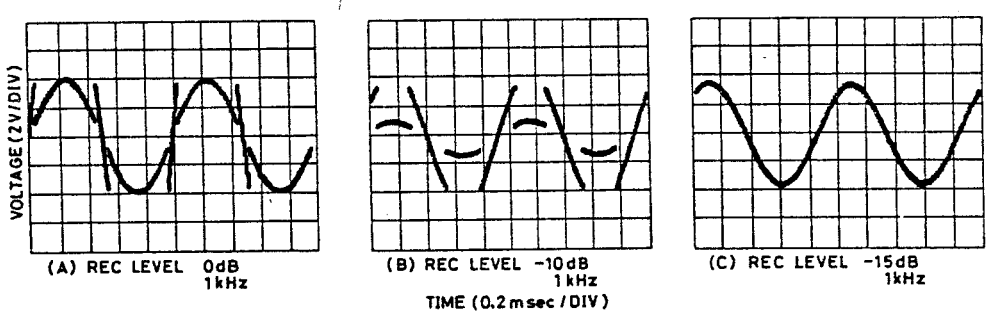


(Fig. 2-6)



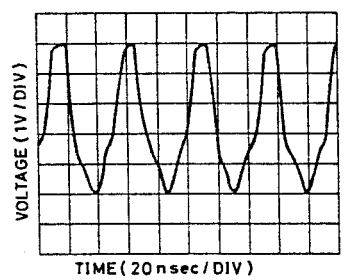
(Fig. 2-7)

The buffer amplifier output (A/D converter input) waveforms (pin (6) of IC6) corresponding to each input level are shown in Fig. 2-8.
This unit utilizes one D/A converter (IC10), which, by combining with a shift register (IC12, 13, 14), a latch (IC16), and an analog comparator (IC11), is operated as an A/D converter during recording and as a D/A converter during playback.



(Fig. 2-8)

1-4 The signal sent in series from the A/D converter is input to the DATA terminal of the REC LSI (IC27) by the data converter.
The 21-MHz clock signal (Fig. 2-9) (pin (3) of IC30) generated as the master clock signal for the REC system is 1/15 frequency divided by IC23 and input to the WBC terminal of the REC LSI as a clock signal for the storage system of the memory (IC20).

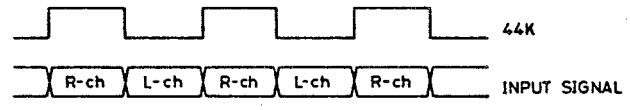


(Fig. 2-9)

Input to the DATA terminal is performed according to the timing of the rising edges of a WBC signal as that shown in Fig. 2-10.

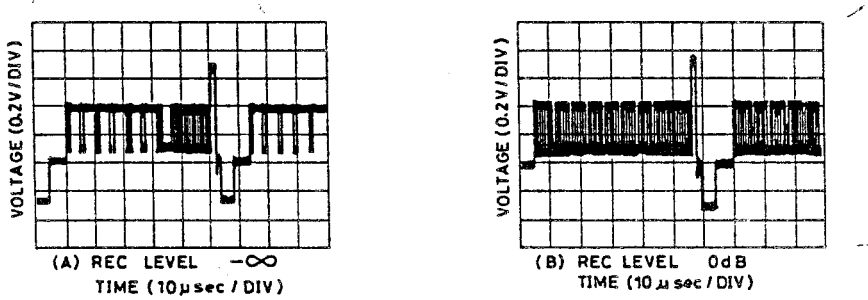
(Fig. 2-10)

The signal which 1/32 frequency divided the pulse input to the WBC terminal is output from the 44K terminal, and the left and right channels of the input signal are separated as shown in Fig. 2-11. The clock signal 1/8 frequency divided by IC19 is input to the RBC terminal as the master clock signal for the video signal system.



(Fig. 2-11)

1-5 In the REC LSI, P and Q parity addition and CRC addition are performed, and the input signal is pulse code modulated. Time axis conversion and interleaving of the pulse code modulated signal are performed in the memory circuit, and then a video signal corresponding to either the NTSC or PAL/SECAM systems is produced, passed through a low-pass filter, and output from the VIDEO OUT terminal. By connecting a video cassette recorder to the VIDEO OUT terminal, the original audio signal (analog signal) can be recorded by PCM on video tape. Fig. 2-12 shows a PAL/SECAM system output waveform from the VIDEO OUT terminal.



(Fig. 2-12)

* Parity (P, Q) (error correction code)
Even if dropout (when the signal is interrupted or confused due to foreign matter or scratches on the tape) should occur, an error correction code, a P, Q code group, is added to every six words (14 bits per word) so that code errors do not occur.

* CRC code (error detection code)
The 16-bit code added to detect errors is used to judge whether or not there is an error in the data divided by a 17-bit binary, and if there is no error, the data is judged as correct, and if there is an error, the data is judged as incorrect.

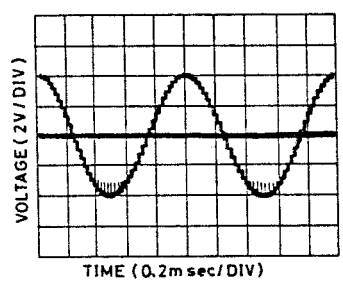
* Interleaving
This is a method which arranges the data (signal) with intervals between them, in order to avoid a succession of errors which cannot be corrected even when P, Q parity is added.

2. Operation of the Playback System

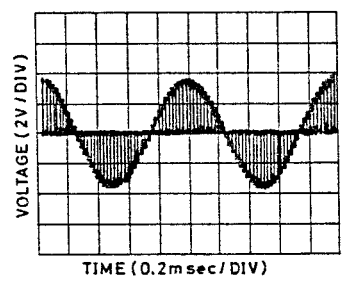
2-1 The video signal reproduced by the video cassette recorder and containing the PCM signal is input to the VIDEO IN terminal, passes through the video amplifier (IC65), and is separated into data and a sync signal in the analog sync separator (IC66).
The data are supplied with timing in the sync separator LSI (IC57) determined by the data-read clock signal and sent to the PLAY LSI (IC53) together with PB-IN-HG which indicates the data interval for each horizontal sync interval.
The sync signal forms the data interval and the vertical sync signal, horizontal sync signal and other control signals in the sync separator LSI.
Of these the vertical sync signal is sent to the VCO circuit, and besides making the master clock signal (FMRI) for the playback system, it is 1/2 frequency divided by IC62 and makes the master clock signal for the PLAY LSI.

2-2 The PB-IN-DATA (data), PB-IN-HG (data interval), and PB-IN-CK (read clock signal) are input from the sync separator LSI to the PLAY LSI where data errors are detected, de-interleaving is performed using an external RAM, incorrect data are corrected, and compensation processing is performed; the signal is then output from DATA OUT in a bit series. This output signal represents the right channel when the 44K output is HIGH and the left channel when the 44K output is LOW.

2-3 This output signal passes though the data converter section and is input to the D/A converter where it is converted to an analog signal. This D/A converter output, after passing through a current/voltage converter buffer amplifier (IC8) and a level expander circuit, enters an aperture circuit composed of an analog switch (IC4) and a buffer amplifier (IC341, 441), and here its left and right channels are separated and it is put out in a PAM wave.
Fig. 2-13 shows the output waveform (pin (4) or (14) of IC4) of the analog switch, which has been processed into left and right channels.
Fig. 2-14 shows the output waveform (pin (6) of IC341, 441) of the aperture circuit.



(Fig. 2-13)

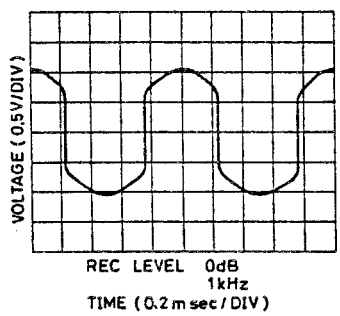


(Fig. 2-14)

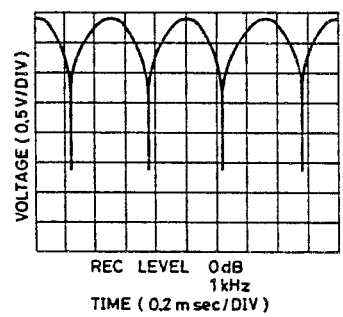
2-4 The PAM wave passes through the same low-pass filter as in the recording system by means of the analog switch and the buffer amplifier and becomes the original analog signal waveform from which the high-frequency component other than the fundamental wave contained in the PAM signal wave has been removed. This signal is input to the de-emphasis circuit, where the emphasized signal is returned to its original flat condition, and output from the LINE OUT terminal.
The switching of the emphasis is automatically performed by the pre-emphasis ON/OFF information recorded during recording and read out during playback by the PLAY LSI.

3. Operation of the Meter Block

The signal which passes through the low-pass filter during either recording or playback passes through the flat amplifier, is amplified by the buffer amplifier (IC391) for the meters, and is input to the meter circuit (IC501, 502, 521). The meter circuit is composed of a logarithmic amplifier circuit, a full-wave rectifier circuit and a digitron driver circuit, and displays the level corresponding to the respective ON and OFF conditions with respect to the emphasis.
Fig. 2-15 shows the output waveform (D505, 506 or D605, 606) of the logarithmic circuit, and Fig. 2-16 shows the output waveform (pin (1) or (7) of IC502) of the full-wave rectifier circuit.



(Fig. 2-15)



(Fig. 2-16)

Note:
Adjustment cannot be performed in this unit when all of the printed circuit boards are in an unadjusted condition. Therefore, when adjusting, use a completely adjusted PLUS 5 set as the standard set and adjust those printed circuit boards that need adjustment by connecting them to the standard set.

Auxiliary Equipment
- Oscilloscope (Frequency band: greater than 100 MHz; measurement sensitivity: less than 5 mV)
- PLUS 5 standard set
- Low-distortion oscillator (distortion: less than 0.003%)
- Full high-frequency distortion meter (measurement range: less than 0.01%)

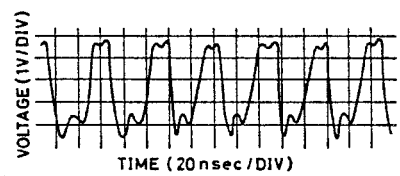
1. Adjustment of the Digital Circuit Board

● Remove the digital circuit board from the standard set, and replace it with the digital circuit board from the set to be adjusted.

1-1 Adjustment of L3

(1) Operate the standard set in the RECORD mode, and observe the waveform from pin (3) of IC30 (SN74ALSOON) on the oscilloscope.

(2) Turn L3 and determine the points where the waveform begins oscillating and where it stops oscillating. The oscillation waveform should appear as shown in Fig. 3-1.



(Fig. 3-1)

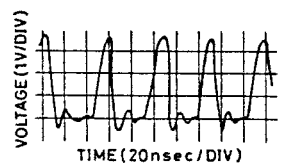
(3) Adjust L3 to a position near the middle of these two points.

(4) Switch the NTSC-PAL/SECAM switch on the rear panel, and confirm that the waveform changes.
Oscillation frequencies NTSC system: 21.146 MHz
PAL/SECAM system: 21.168 MHz

1-2 Adjustment of L6

(1) Switch the standard set to the PLAYBACK mode, and observe the waveform from pin (3) of IC60 (SN74ALSOON) on the oscilloscope.

(2) Turn L6 and determine the points where the waveform begins oscillating and where it stops oscillating. The oscillation waveform should appear as shown in Fig. 3-2.



(Fig. 3-2)

(3) Adjust L6 to a position near the middle of these two points.

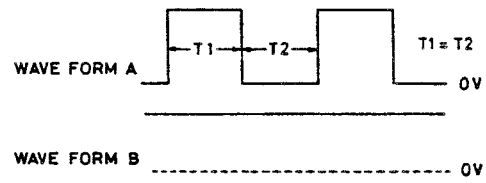
1-3 Adjustment of L4

(1) Switch the standard set back to the RECORD mode, and connect the VIDEO IN and VIDEO OUT terminals on the rear panel.

(2) Observe the waveform (waveform A) from pin (6) of IC58 (SN74LS08N) and the waveform (waveform B) from pin (3) of IC47 (SN74LS00N).

(3) Turn L4 and determine the point where waveform B becomes HIGH and waveform A stabilizes and becomes the period pulse shown below.

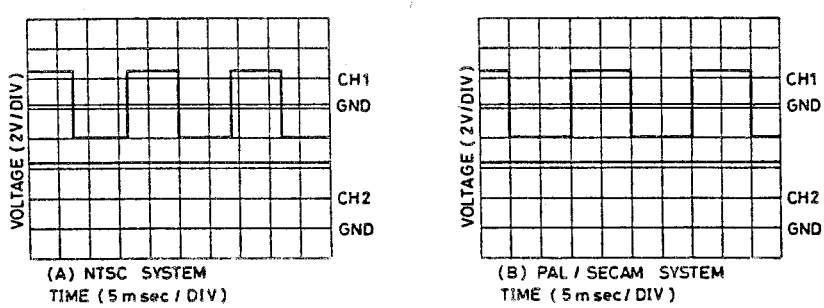
NTSC	16.7 mS
PAL/SECAM	20.0 mS



(Fig. 3-3)

(4) Fine adjust L4 so that waveform A becomes duty 50 as shown in Fig. 3-3. At this time confirm that all three LEDs on the front panel of the set which indicate the tracking condition illuminate.

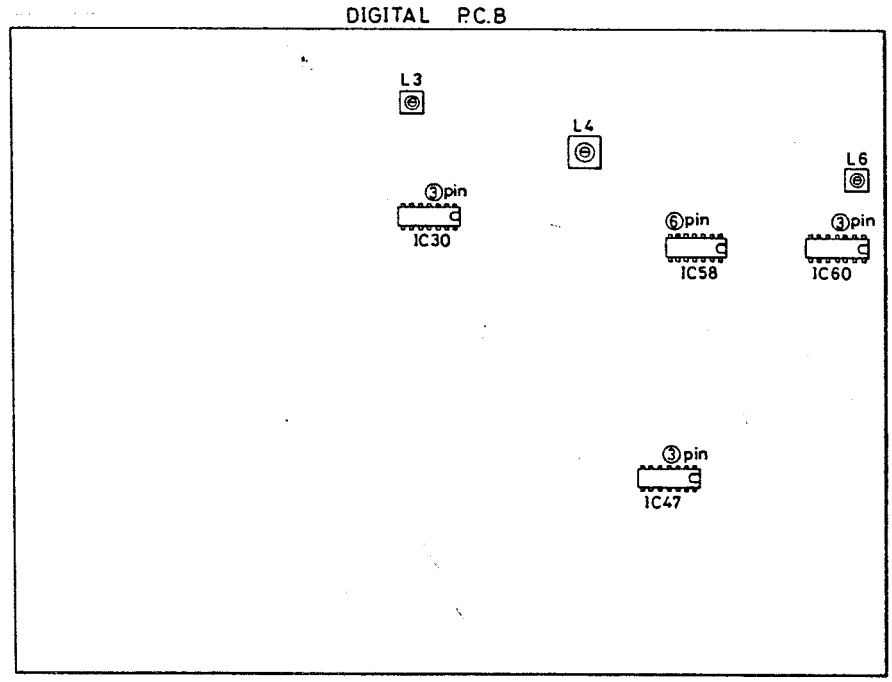
(5) Confirm that waveform A remains stabilized at duty 50 even when the NTSC-PAL/SECAM switch on the rear panel is switched.
Fig. 3-4 shows waveforms by the respective systems.



(Fig. 3-4)

- Return the adjusted digital circuit board to the set being adjusted and the digital circuit board of the standard set to its original location in the standard set.

PARTS LOCATION (DIGITAL)



2. Adjustment of the Analog Circuit Board

Positions of the respective controls and switches before adjustment.
INPUT LEVEL control: minimum
OUTPUT LEVEL control: maximum
PHONES LEVEL control: maximum
INPUT SELECT switch: line

o Remove the analog circuit board from the standard set and replace it with the analog circuit board from the set to be adjusted.

2-1 Adjustment of SVR342 and 442
(1) Connect short-circuit test lead A to the analog circuit to be adjusted, and switch ON the power to the standard set.
(2) Connect the oscilloscope between aL and GND, and adjust SVR342 so that the DC offset voltage becomes 0 V.
(3) Adjust SVR442 in the same way so that the DC offset voltage between aR and GND becomes 0 V.
(4) Remove short-circuit test lead A.

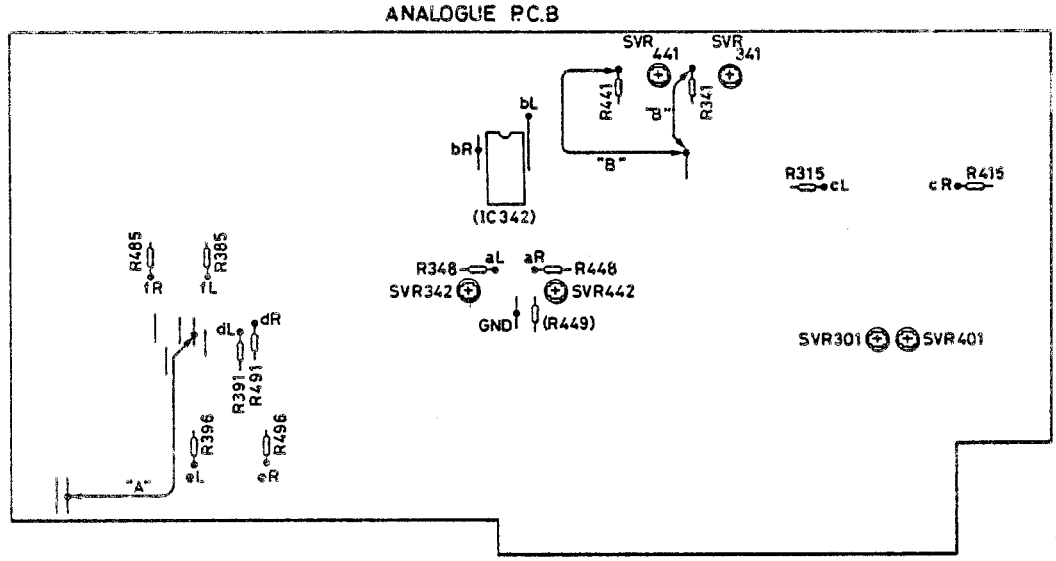
2-2 Adjustment of SVR341 and 441
(1) Connect short-circuit test lead B to the analog circuit board to be adjusted, and switch ON the power to the standard set.
(2) Connect the oscilloscope between bL and GND, and adjust SVR341 so that the DC offset voltage becomes 0 V.

(3) Adjust SVR441 in the same way so that the DC offset voltage between bR and GND becomes 0 V.
(4) Remove short-circuit test lead B.

2-3 Adjustment of SVR301 and 401
(1) Switch ON the power to the standard set, and connect the oscilloscope between cL and GND.
(2) Adjust SVR301 so that the DC offset voltage becomes 0 V. In this adjustment, since the amplifier gain is HIGH, a little time is required before the offset voltage stabilizes.
(3) Adjust SVR401 in the same way so that the DC offset voltage between cR and GND becomes 0 V.
● Return the adjusted analog circuit board to the set being adjusted and the analog circuit board of the standard set to its original location in the standard set.

PARTS LOCATION (ANALOGUE)

ANALOGUE P.C.B



3. Adjustment of the A/D-D/A Circuit Board
* In order to adjust this circuit board, in addition to a PLUS 5 standard set (No. 1) for adjustment, another completely adjusted PLUS 5 set (No. 2) is required.

Positions of the respective controls and switches of standard set No.1 and standard set No. 2 before adjustment.

INPUT LEVEL control:	minimum
OUTPUT LEVEL control:	maximum
INPUT SELECT switch:	line
EMPHASIS switch:	on
DIGITAL COPY switch:	off

- Remove the A/D-D/A circuit board from standard set No. 1, and replace it with the A/D-D/A circuit board from the set to be adjusted.

A Adjustment of the recording system (A/D)

3-1 Adjustment of VR1

(1) Connect TP2 and GND of the A/D-D/A circuit board attached to standard set No. 1, and operate the set in the RECORD mode.

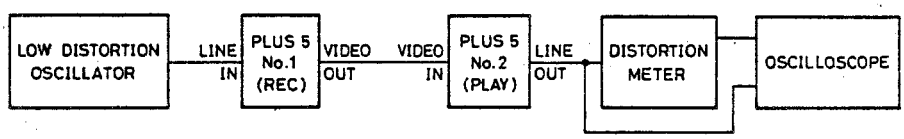
(2) Connect the oscilloscope between TP1 and GND of standard set No. 1, and adjust VR1 so that the center of the noise waveform becomes 0 V as shown in Fig. 3-5.

(Fig. 3-5)

(3) Remove the lead between TP2 and GND.

3-2 Adjustment of VR3 and VR6

(1) Connect the equipment as shown in Fig. 3-6, and operate standard set No. 1 in the RECORD mode and standard set No.2 in the PLAYBACK mode.



(Fig. 3-6)

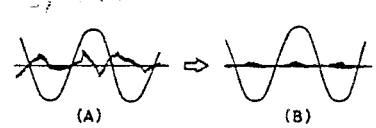
(2) Turn the INPUT LEVEL control of standard set No. 1 to maximum, and input a 420-Hz signal (approximately 140 mV) from the low-distortion oscillator to the LINE IN terminal.

(3) Observe the output from the LINE OUT terminal on the back of standard set No. 2 on the oscilloscope, and confirm that a 1.2 - 1.4-V sine wave output appears.

(4) Adjust the INPUT LEVEL control of standard set No. 1 so that the LINE OUT output becomes 1.2 V.

(5) While observing the LINE OUT output waveform and the distortion waveform of standard set No. 2, adjust VR3 and VR6 of standard set No. 1 so that the distortion becomes minimal.

(6) Next, decrease the input by 10 dB with the INPUT LEVEL control. If the distortion waveform at this time is as shown in Fig 3-7(A), readjust VR3 and VR6 so that it becomes as shown in (B).

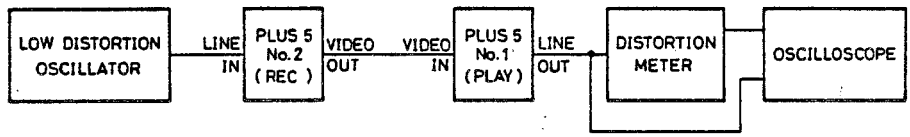


(Fig. 3-7)

B Adjustment of the playback system (D/A)

3-3 Adjustment of VR2

(1) Connect the equipment as shown in Fig. 3-8, and operate standard set No. 2 in the RECORD mode and standard set No. 1 in the PLAYBACK mode.



(Fig. 3-8)

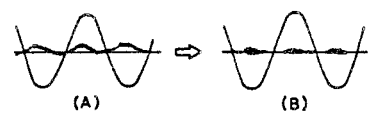
(2) Turn the INPUT LEVEL control of standard set No. 2 to maximum, and input a 420-Hz signal (approximately 350 mV) from the low-distortion oscillator to the LINE IN terminal.

(3) Observe the output from the LINE OUT terminal of standard set No. 1, and confirm that a 1.5 - 1.8-V sine wave output waveform appears.

(4) Adjust the INPUT LEVEL control of standard set No. 2 so that the LINE OUT output becomes 1.78 V.

(5) While observing the LINE OUT output waveform and the distortion waveform of standard set No. 1 on the oscilloscope, adjust VR2 of standard set No. 1 so that the distortion becomes minimal.

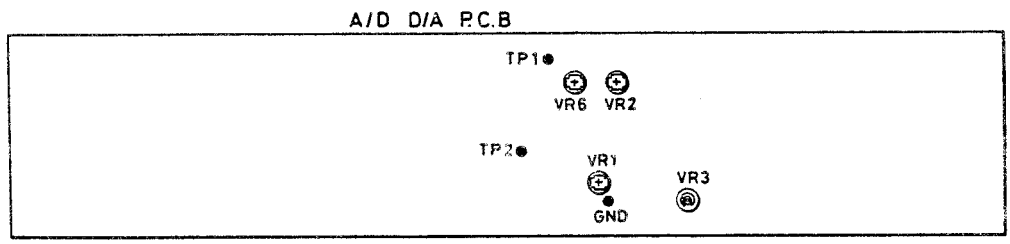
(6) Next, decrease the input by 5 dB with the INPUT LEVEL control, and if the distortion waveform at this time is as in Fig. 3-9 (A), readjust VR2 so that it becomes like the waveform in (B).



(Fig. 3-9)

- Return the adjusted A/D-D/A circuit and the standard set A/D-D/A circuit board to their original locations.

PARTS LOCATION (A/D , D/A)



4. Adjustment of the Meter Circuit Board

Positions of the respective controls and switches before testing

INPUT LEVEL control:	maximum
OUTPUT LEVEL control:	maximum
INPUT SELECT switch:	line
EMPHASIS switch:	off
PEAK HOLD switch:	off

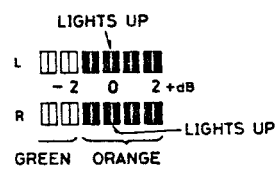
- Remove the meter circuit board from the standard set, and replace it with the meter circuit board from the set to be adjusted.

Adjustment of SVR501, 601 and 521

(1) Operate the standard set in the PLAYBACK mode.
(2) Input a 1-kHz signal (approximately 140 mV) from the low-distortion oscillator to the LINE IN terminal on the rear panel of the set.
(3) Adjust the level of the low-distortion oscillator so that the output from the LINE OUT terminal on the rear panel of the set becomes 1.78 V.
(4) Turn SVR501 and 601 clockwise all the way.
(5) Connect the oscilloscope between D509 and D521 and between D609 and D521, and confirm that a waveform such as that in Fig. 3-10 appears.

(Fig. 3-10)

(6) Adjust SVR521 so that the 0 dB segment of the PEAK LEVEL METER on the front panel of the set illuminates as shown in Fig. 3-11. If there is a difference between the display levels of the right and left channels at this time, fine adjust SVR501 and 601.

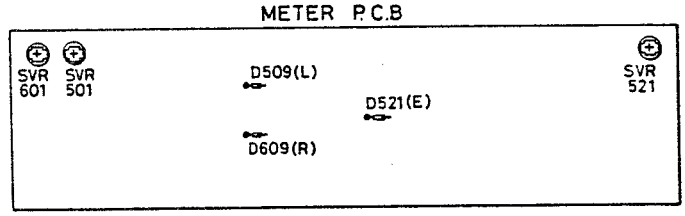


(Fig. 3-11)

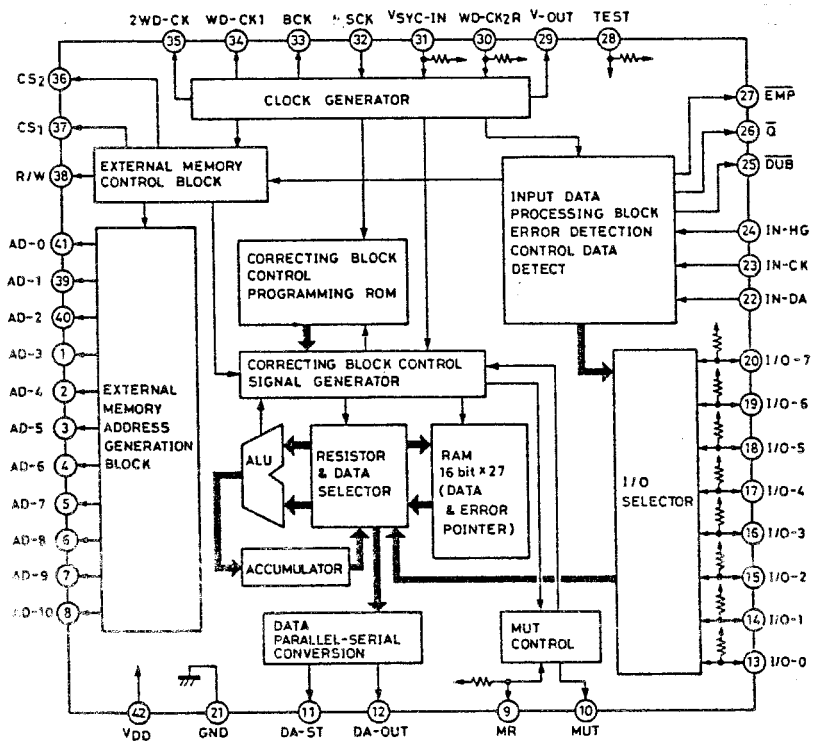
(7) Press the PEAK HOLD switch on the front panel, and confirm that the illuminated segment of the maximum point remains illuminated even after the level drops.

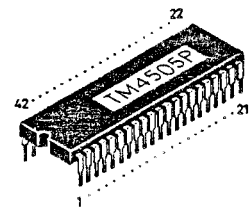
- Return the adjusted meter circuit board and the standard set meter board to their original locations.

PARTS LOCATION (METER)

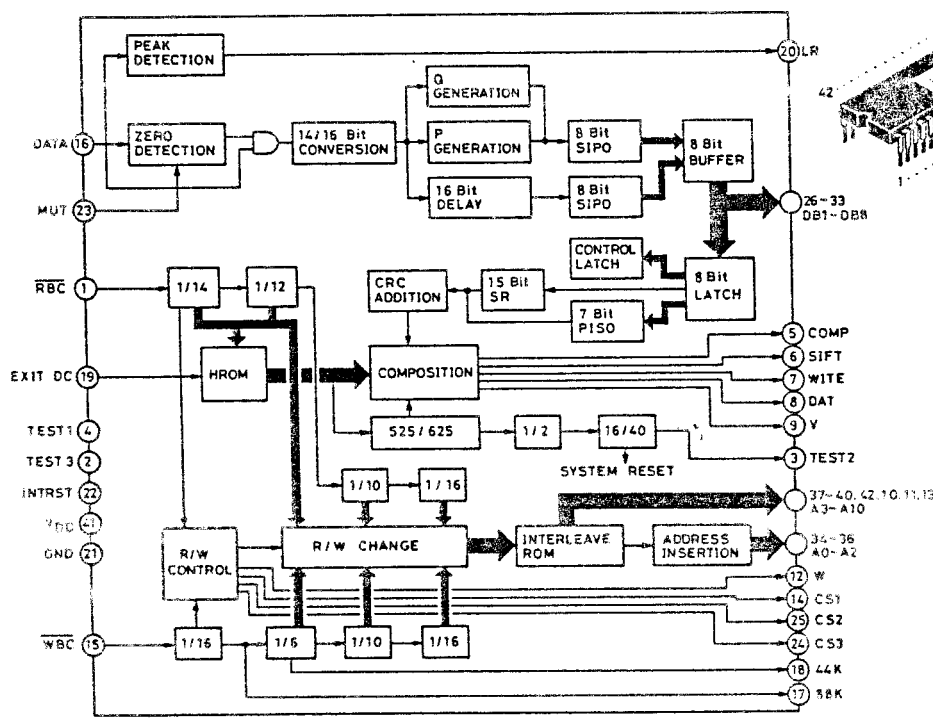


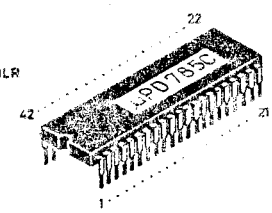
IC53 TM4505P
PCM DECORDING PROCCESSOR



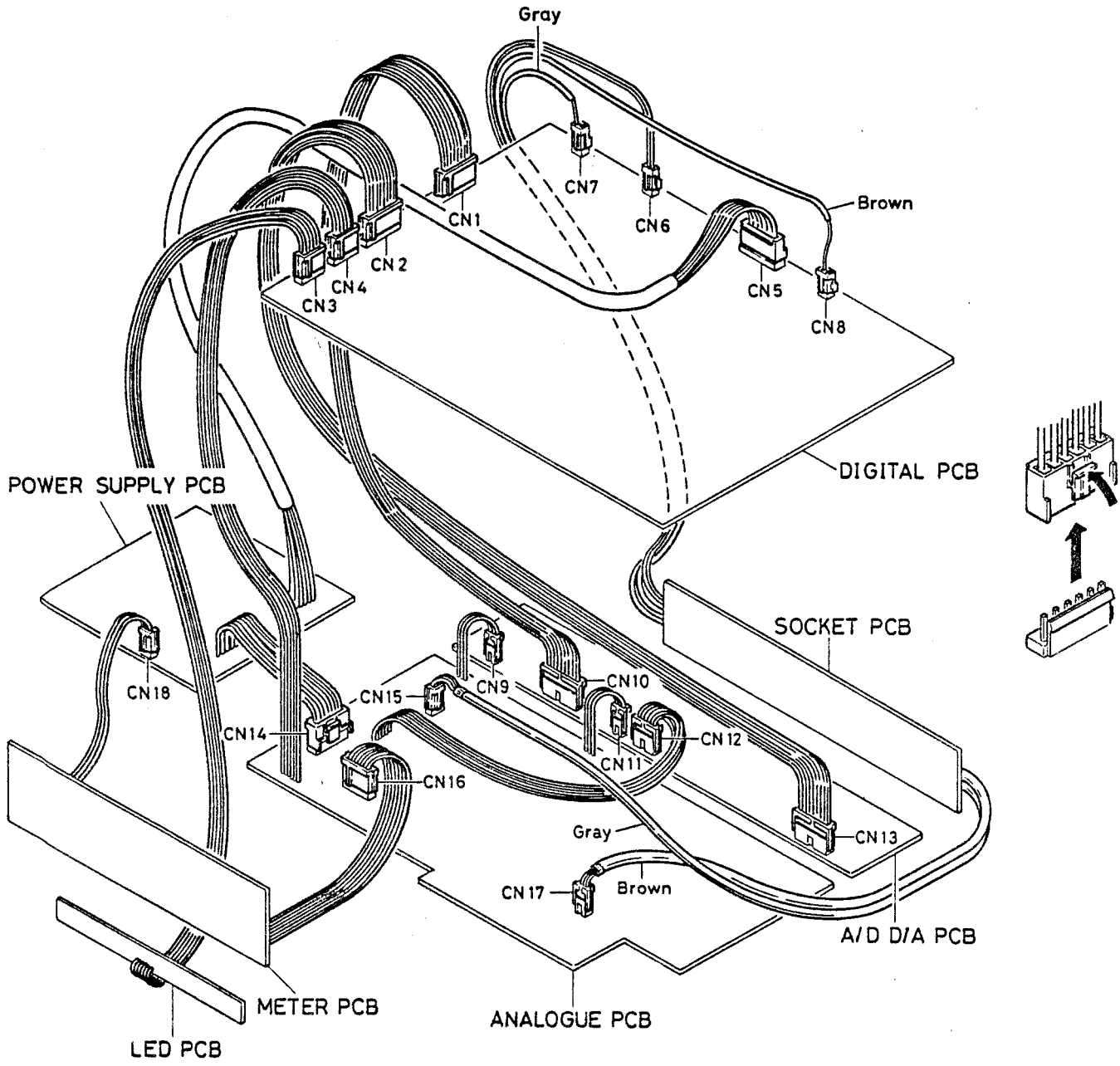


IC27 μPD785C
DATA PROCCESSOR FOR PCM RECORDER

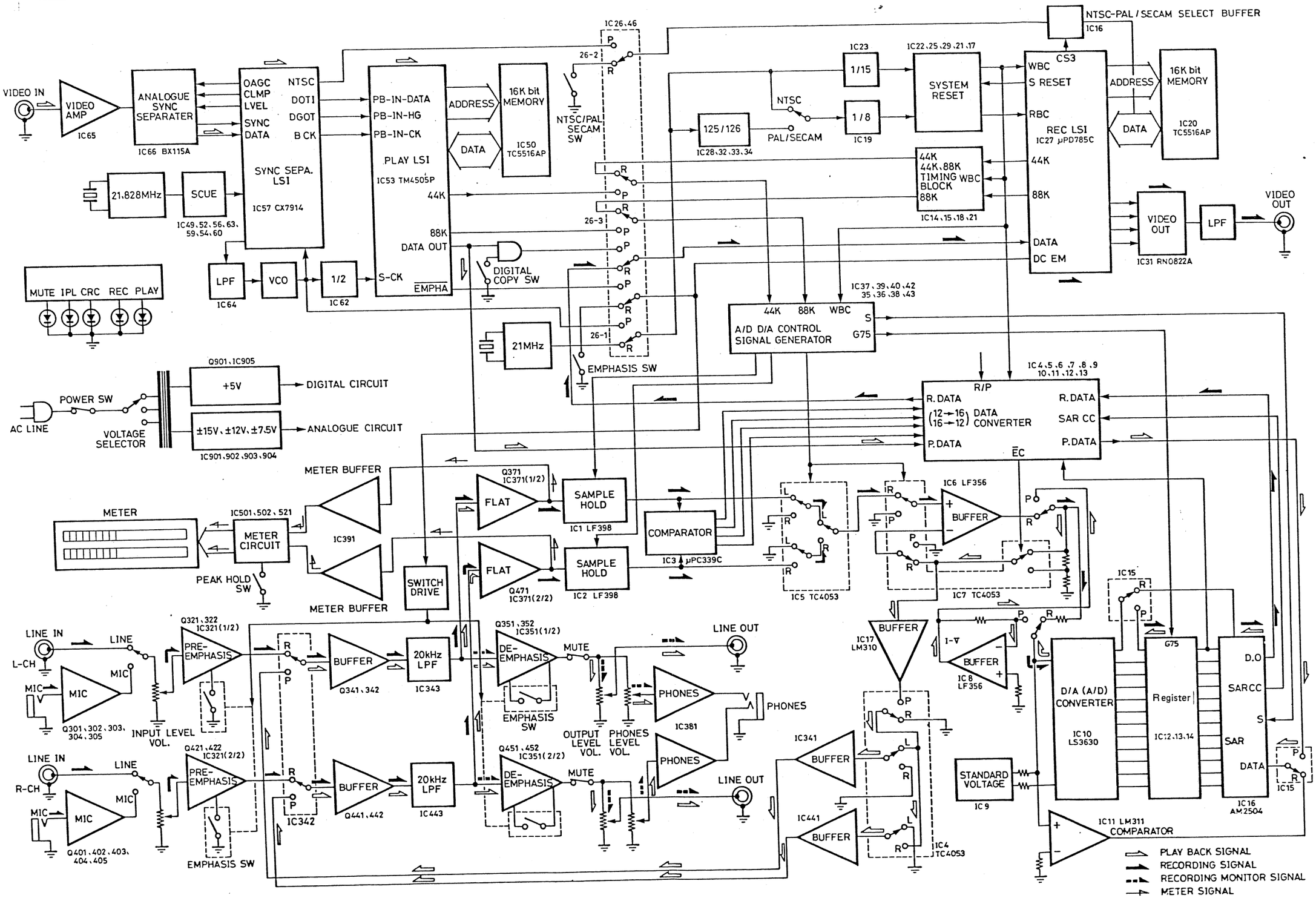


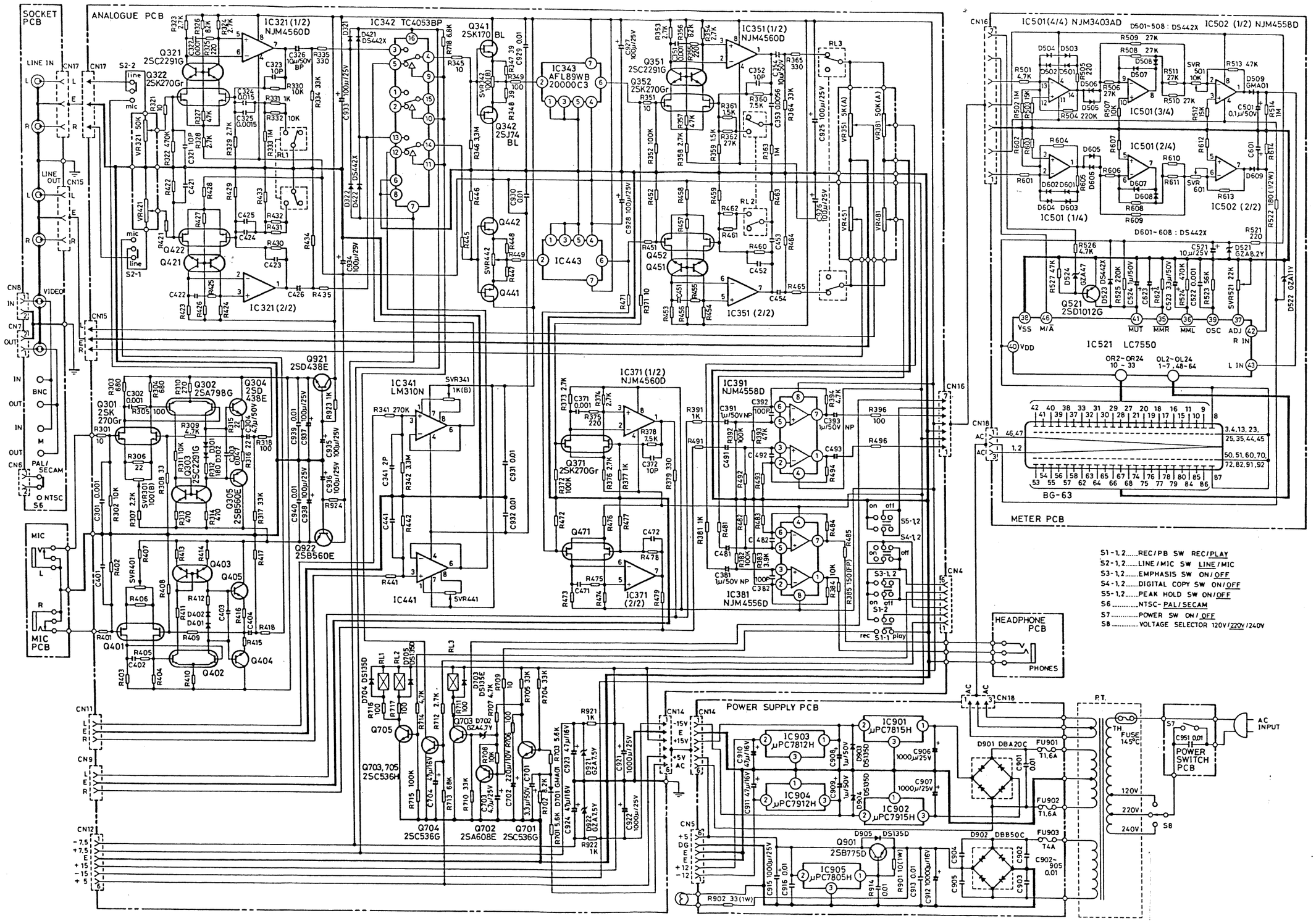


.CONNECTION DIAGRAM



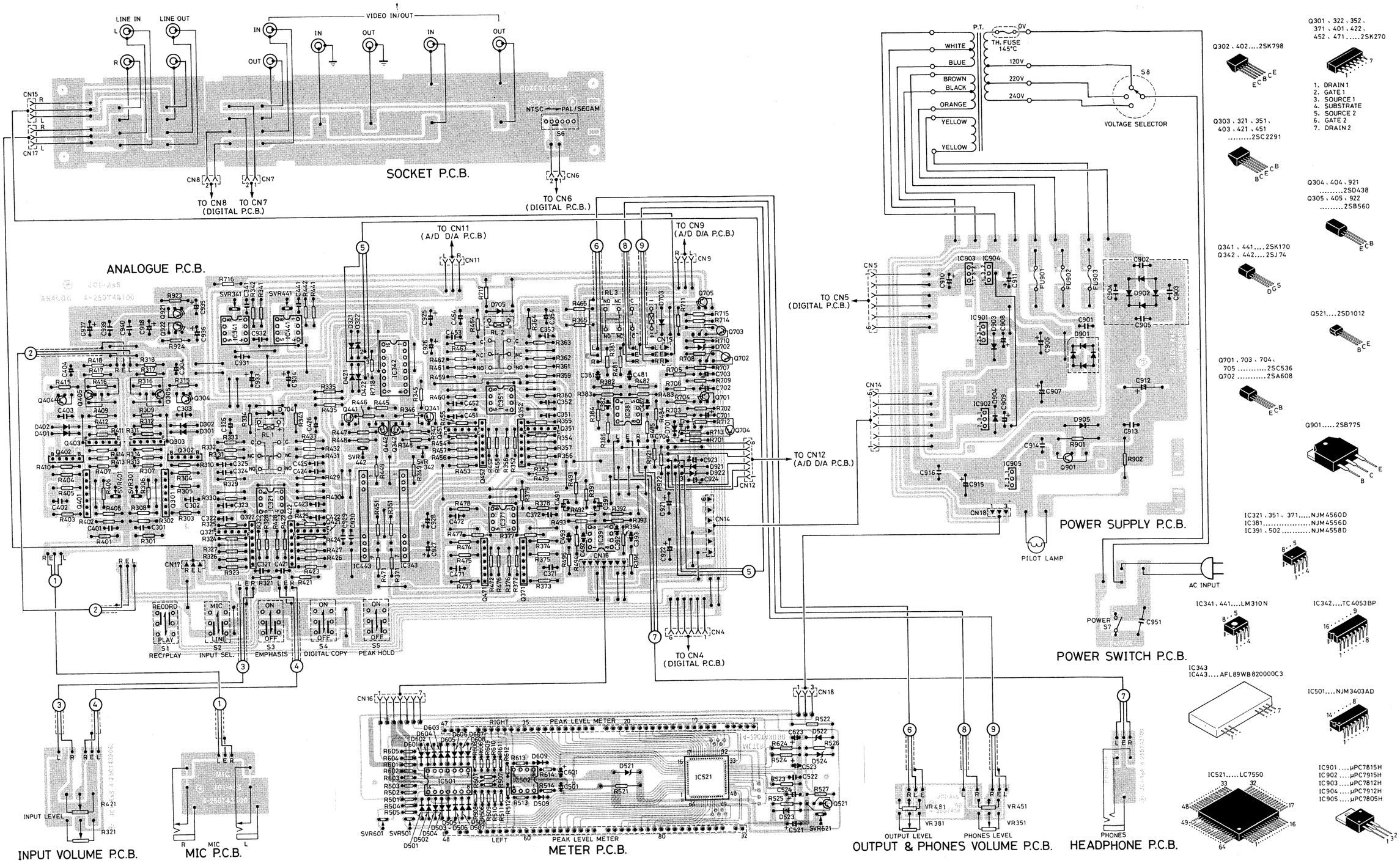
BLOCK DIAGRAM





S1-1, 2 ..... REC/PB SW REC/PLAY
S2-1, 2 ..... LINE/MIC SW LINE/MIC
S3-1, 2 ..... EMPHASIS SW ON/OFF
S4-1, 2 ..... DIGITAL COPY SW ON/OFF
S5-1, 2 ..... PEAK HOLD SW ON/OFF
S6 ..... NTSC-PAL/SECAM
S7 ..... POWER SW ON/OFF
S8 ..... VOLTAGE SELECTOR 120V/220V/240V

WIRING DIAGRAM (ANALOGUE)



Q302 , 402....2SK798

Q303 , 321 , 351 , 403 , 421 , 451 .....2SC2291

Q341 , 441....2SK170
Q342 , 442....2SJ74

Q701 , 703 , 704 , 705 .....2SC536
Q702 .....2SA608

Q301 , 322 , 352 , 371 , 401 , 422 , 452 , 471.....2SK270

1. DRAIN 1
2. GATE 1
3. SOURCE 1
4. SUBSTRATE
5. SOURCE 2
6. GATE 2
7. DRAIN 2

Q304 , 404 , 921 .....2SD438
Q305 , 405 , 922 .....2SB560

Q521....2SD1012

Q901.....2SB775

IC321 , 351 , 371.....NJM4560D
IC381.....NJM4556D
IC391 , 502.....NJM4558D

IC341 , 441....LM310N

IC342....TC4053BP

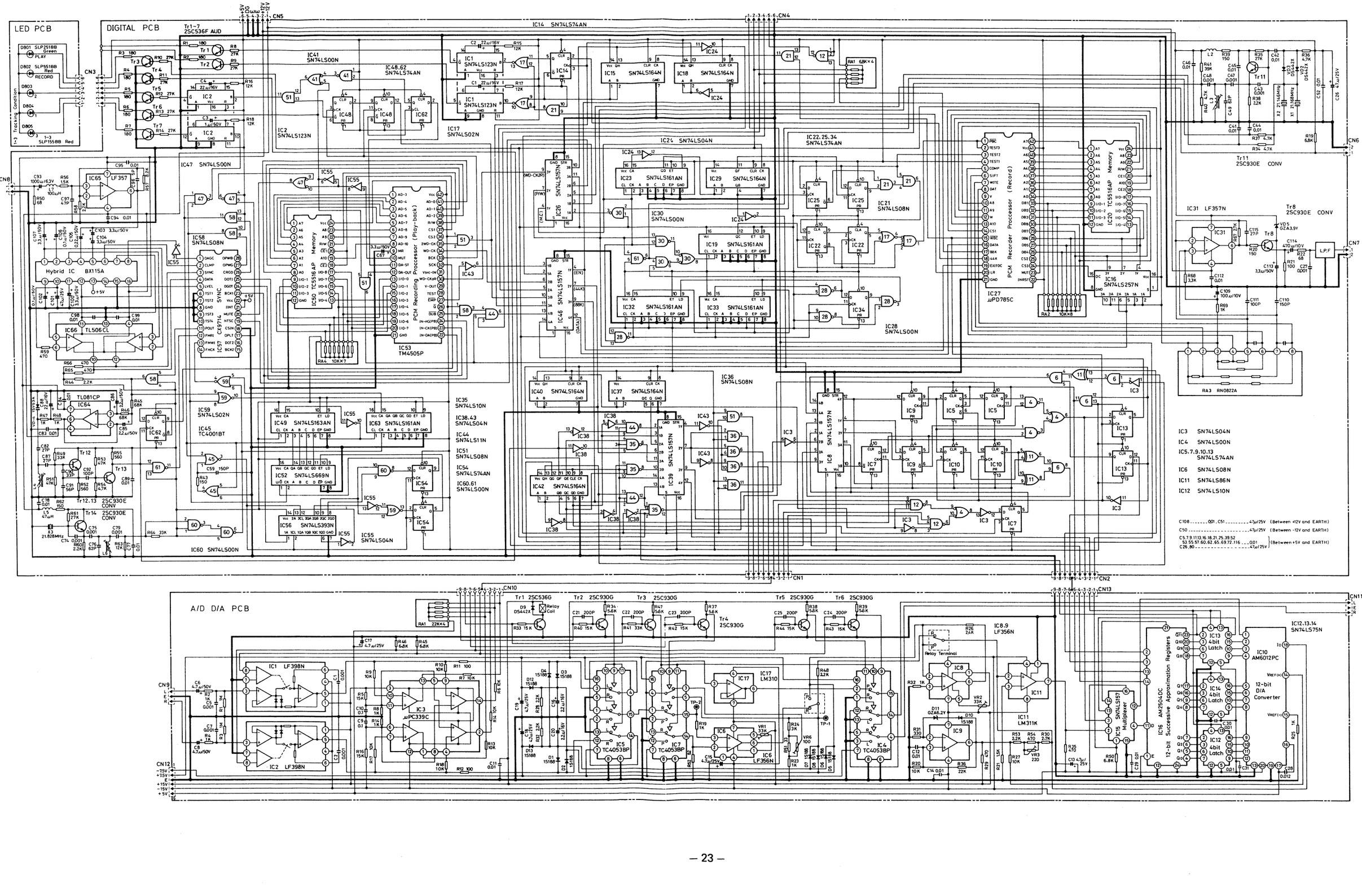
IC343
IC443....AFL89WB820000C3

IC501....NJM3403AD

IC521.....LC7550

IC901 ....μPC7815H
IC902 ....μPC7915H
IC903 ....μPC7812H
IC904 ....μPC7912H
IC905 ....μPC7805H

SCHEMATIC DIAGRAM (DIGITAL)



A/D·D/A PCB
IC·TR Pin connection

2SC536 ····· TR1,5,6
2SC930 ····· TR2,3,4

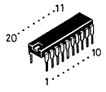
LF398N ····· IC1,2
LM311K ····· IC11

μPC339C ····· IC3

TC4053BP ····· IC4,5,7

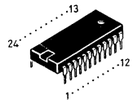
LF356N ····· IC6,8,9

AM6012PC ····· IC10

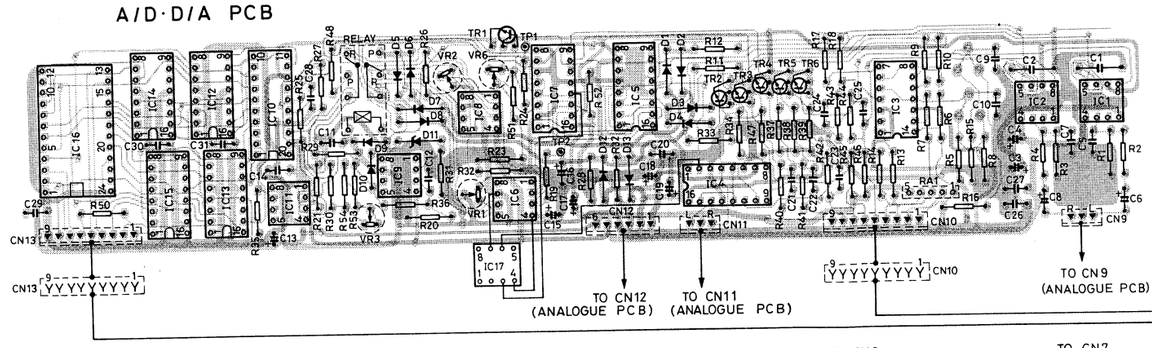


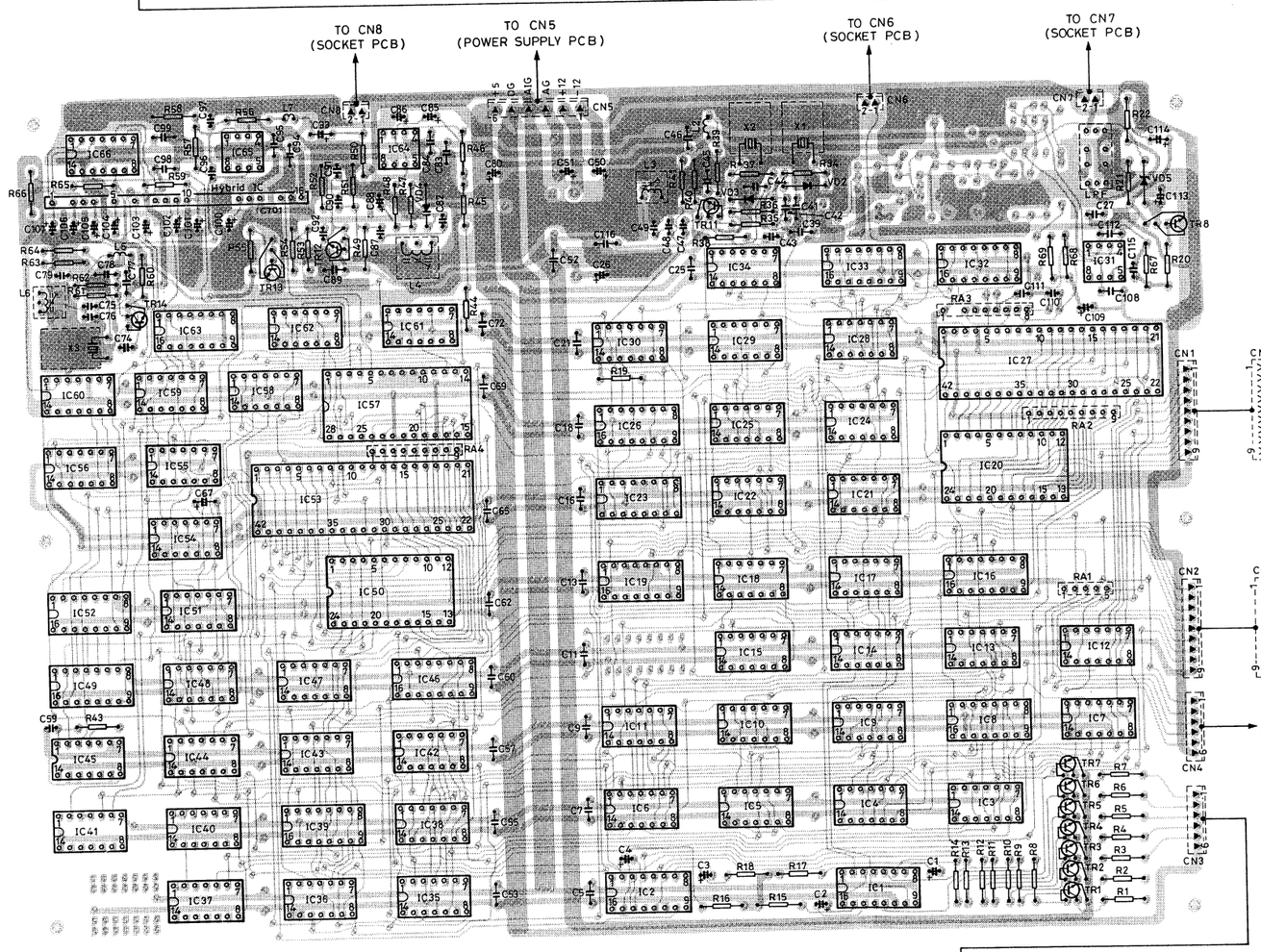
SN74LS75N ····· IC12,13,14
SN74LS157N ····· IC15

AM2504DC ····· IC16

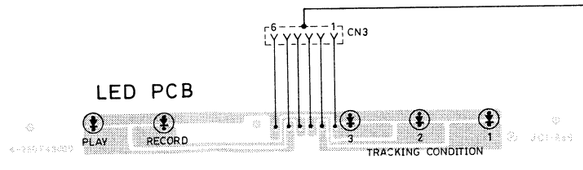


A/D·D/A PCB





DIGITAL PCB



LED PCB

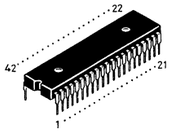
DIGITAL PCB
IC·TR Pin connection

2SC536 ····· TR1~7
2SC930 ····· TR8, 11~14

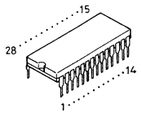
SN74LS123N ····· IC1,2
SN74LS157N ····· IC8,26,39,46
SN74LS161AN ····· IC19,23,32,33,63
SN74LS257N ····· IC16
SN74LS163AN ····· IC49
SN74LS669N ····· IC52

TL506CN ····· IC66
SN74LS04N ····· IC3,24,38,43,55
SN74LS00N ····· IC4,41,47
SN74LS74AN ····· IC5,7,9,10,13,14
IC22,25,48,54
SN74LS08N ····· IC6,21,36,51,58
SN74LS86N ····· IC11
SN74LS10N ····· IC12,35
SN74LS164N ····· IC15,18,29,37,40,42
SN74LS02N ····· IC17
SN74ALS00N ····· IC28,30,60,61
SN74ALS74N ····· IC34,62
SN74LS11N ····· IC44
SN74LS393N ····· IC56
SN74ALS02N ····· IC59
TC4001BP ····· IC45

μPD785C ····· IC27
TM4505P ····· IC53



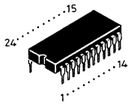
CX7914 ····· IC57



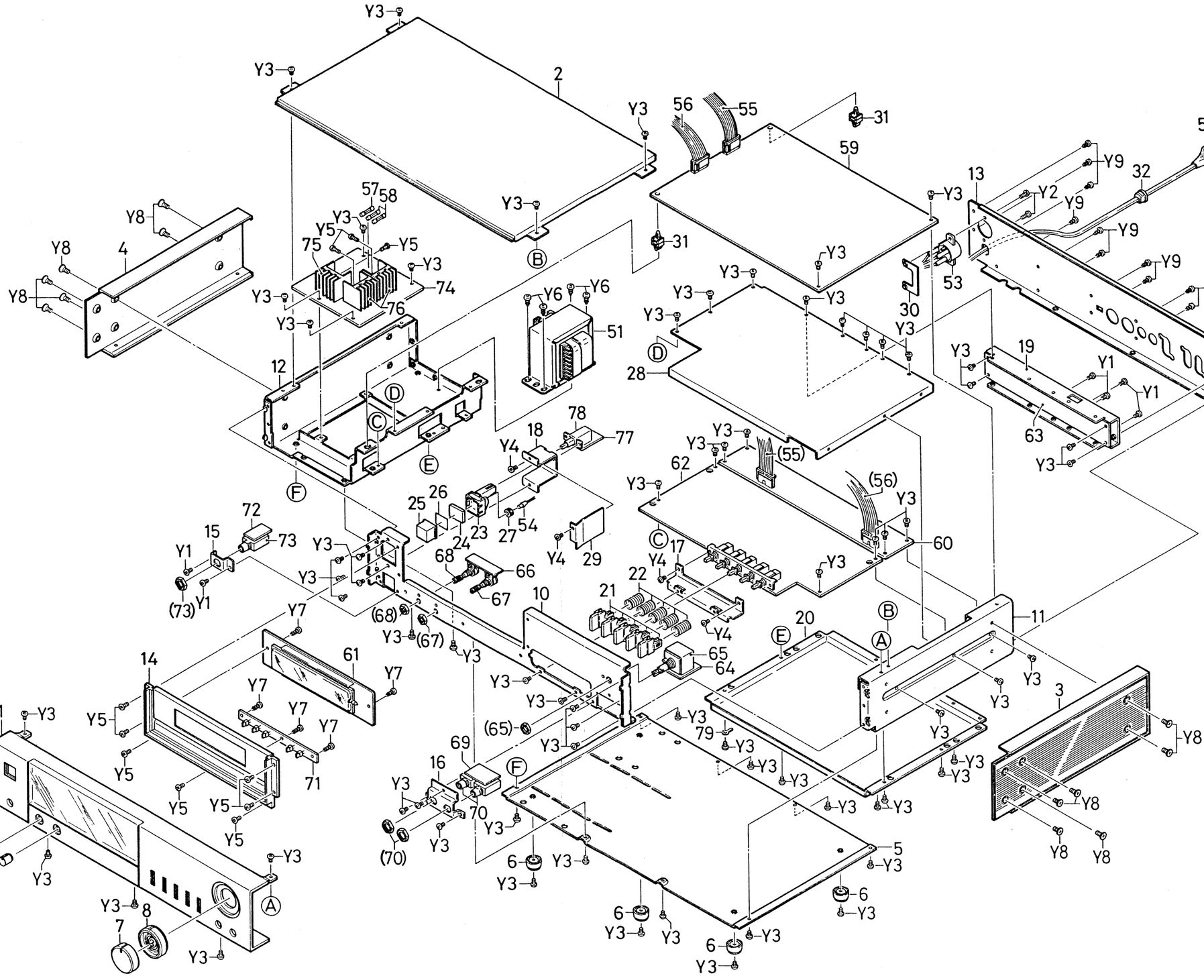
LF357N ····· IC31,65

TL081CP ····· IC64

TC5516AP ····· IC20,50



EXPLODED VIEW



PARTS LIST

Key. No.	Part No.	Description	Q'ty
ANALOGUE P. C. B. ASS'Y			
	RESISTORS		
R708		10K ohm	1
R702		8.2K ohm	1
R718		6.8K ohm	1
R701,703		5.6K ohm	2
R393,493, 394,494, 707,714		4.7K ohm	6
R383,483		3.9K ohm	2
R323,423, 324,424, 328,428		2.7K ohm	6
R353,453, 354,454, 358,458		2.7K ohm	6
R373,473, 374,474, 376,476		2.7K ohm	6
R307,407		2.2K ohm	2
R381,481, 923,924, 391,491		1K ohm	6
R712		2.7K ohm	1
R303,403, 304,404		680 ohm	4
R313,413, 314,414		470 ohm	4
R335,435, 365,465, 379,479		330 ohm	6
R310,410		270 ohm	2
R325,425, 355,455, 375,475		220 ohm	6
R312,412		180 ohm	2
R305,405 318,418, 349,449		100 ohm	6
R396,496, 706,711, 716,717		100 ohm	6
R347,447, 348,448		39 ohm	4
R315,415, 316,416, 306,406		22 ohm	6
R301,401, 321,421		10 ohm	4
R345,445, 351,451, 371,471		10 ohm	6
R709		10 ohm	1
SOCKET P. C. B. ASS'Y			
63	141-4-250T-43200	P.C.B. Ass'y, Socket	1
	4-240T-35200	Socket, RCA 4p Line in out	1
	4-240T-35100	Socket, RCA 2p Video in ont	1
	4-240T-35300	Socket, Video in out	2
	4-240T-35400	Socket, Video in out	2
	4-231T-54300	Switch, NTSC/PAL/SECAM	1
CN17	4-240T-36000	Socket, Line in	1
CN15	4-240T-36100	Socket, Line out	1
	4-240T-36200	Socket, NTSC/PAL/SECAM	1
CN8	4-240T-36600	Socket, Video in	1
CN7	4-240T-36700	Socket, Video out	1
INPUT VOLUME P. C. B. ASS'Y			
64	141-4-250T-43300	P.C.B. Ass'y, Input Volume	1
65	4-220T-04600	Variable Resistor, Input Volume	1

Key. No.	Part No.	Description	Q'ty
OUTPUT & PHONES VOLUME P. C. B. ASS'Y			
66	141-4-250T-43400	P.C.B. Ass'y, Output & Phones Volume	1
67	4-220T-04700	Variable Resistor, Output Volume	1
68	4-220T-04800	Variable Resistor, Phones Volume	1
MIC P. C. B. ASS'Y			
69	141-4-250T-43500	P.C.B. Ass'y, Mic	1
70	4-240T-37074	Socket, RCA 4p	2
LED P. C. B. ASS'Y			
71	141-4-250T-43600	P.C.B. Ass'y, LED	1
	4-240T-36300	Socket	1
D802		LED SLP151B Red	1
D801,803, 804,805		LED SLP251B Green	4
HEAD PHONE P. C. B. ASS'Y			
72	141-4-250T-43700	P.C.B. Ass'y, Headphone	1
73	4-240T-37071	Socket, RCA 4p	1
POWER SUPPLY P. C. B. ASS'Y			
74	141-4-250T-43800	P.C.B. Ass'y, Power Supply	1
75	141-2-368T-26600	Heat Sink	1
76	141-2-368T-26700	Heat Sink	2
	141-2-381T-04200	Bracket Fuse	1
	4-240T-36400	Socket	1
	4-240T-36500	Socket	1
	4-236T-19771	Plug, 3p	1
	141-2-327T-26100	Insulator	2
	141-2-327T-26172	Insulator	1
IC905		IC μPC7805H	1
IC901		IC μPC7815H	1
IC902		IC μPC7915H	1
IC903		IC μPC7812H	1
IC904		IC μPC7912H	1
Q901		Transistor 2SB775	1
D902		Diode DBB50 C	1
D901		Diode DBA20 C	1
D903,904, 905		Diode DS135 D	3
	CAPACITORS		
C912	4-163T-09100	Electrolytic	1
C906,907, 916	4-163T-09200	Electrolytic	3
C908,909		Electrolytic 1μF 50V	2
C910,911		Electrolytic 47μF 16V	2
C901		Mylar 0.01μF ±20% 250V	1
C902,903, 904,905, 913,914		Ceramic 0.01μF +80—20% 50V	6
C915		Ceramic 0.01μF +80—20% 50V	1
	RESISTORS		
R902		Metal 33 ohm ±5% 1W	1
R901		Metal 10 ohm ±5% 1W	1
POWER SWITCH P. C. B. ASS'Y			
77	141-4-250T-43900	P.C.B. Ass'y, Power Switch	1
78	4-238T-30100	Switch	1
C951	4-223T-12100	Capacitor 0.01μF 400V	1
	141-2-135T-75700	Cover	1
	141-2-382T-18900	Terminal	2

SANYO ELECTRIC TRADING CO., LTD.
33, Hiyoshi-cho 2-chome, Moriguchi-shi,
Osaka-fu, 570 Japan.

Nov./'82/100 KM Printed in Japan.

PARTS LIST

METER P. C. B. ASS'Y

Key. No.	Part No.	Description	Q'ty
	CAPACITORS		
C523,623		Electrolytic 3.3μF 50V	2
C524		Electrolytic 1μF 50V	1
C501,601		Electrolytic 0.1μF 50V	2
C521		Electrolytic 10μF 25V	1
C522		Mylar 0.001μF ±5% 50V	1
	RESISTORS		
	All Resistors are Carbon P-type ±5% 1/6W, unless otherwise noted.		
R521		FP- Carbon 220 ohm ½W	1
R522		FP-Carbon 180 ohm ½W	1
R502,602, 514,614		1M ohm	4
R504,604		220K ohm	2
R513,613		47K ohm	2
R506,606, 508,608, 509,609		27K ohm	6
R510,511, 611,610		27K ohm	4
R503,603, 512,612		15K ohm	4
R507,607		10K ohm	2
R501,601		4.7K ohm	2
R505,605		220 ohm	2
R524,624		470K ohm	2
R525		220K ohm	1
R523		56K ohm	1
R527		47K ohm	1
R526		4.7K ohm	1

ANALOGUE P. C. B. ASS'Y

Key. No.	Part No.	Description	Q'ty
62	141-4-250T-43100	P.C.B. Ass'y, Analogue	1
79	141-2-472R-00401	Lug,	1
	4-238T-58500	Push Switch	1
	4-232T-06600	Relay	3
SVR301, 401,342, 442	4-220T-04900	Semi-Variable Resistor 100 ohm	4
SVR341, 441	4-220T-04976	Semi-Variable Resistor 1K ohm	2
CN15,17	4-236T-19771	Plug, 3p	2
CN16	4-236T-19775	Plug, 7p	1
CN14	4-236T-21874	Plug, 6p	1
CN12	4-240T-35700	Socket	1
CN9,11	4-240T-35800	Socket	2
CN4	4-240T-35900	Socket	1
IC343,443		IC AFL89WB20000C3	2
IC321,351, 371		IC NJM4560D	3
IC381		IC NJM4556D	1
IC391		IC NJM4558DD	1
IC342		IC TC4053BP	1
IC341,441		IC LM310N	2
Q301,401, 322,422, 352,452		Transistor FET 2SK270 Green	6
Q371,471		Transistor FET 2SK270 Green	2
Q341,441		Transistor FET 2SK170 Black	2
Q342,442		Transistor FET 2SJ74 Black	2
Q302,402		Transistor 2SA798	2
Q303,403, 321,421, 351,451		Transistor 2SC2291	6
Q304,404, 921		Transistor 2SD438	3
Q305,405 922		Transistor 2SB560	3
Q703,705		Transistor 2SC536 AUD	2
Q701,704		Transistor 2SC536 AUD	2
Q702		Transistor 2SC608 SP	1
D921,922		Zener Diode GZA7.5Y	2
D702		Zener Diode GZA4.7Y	1
D703,704, 705		Diode DS135	3
D301,401, 302,402, 321,421		Diode DS442 X	6

ANALOGUE P. C. B. ASS'Y

Key. No.	Part No.	Description	Q'ty
D322,422		Diode DS442 X	2
D701		Diode GMA01	1
	CAPACITORS		
C921,922	4-163T-09200	Electrolytic	2
C925,926, 927,928, 933,934	4-163T-09300	Electrolytic	6
C937,938	4-163T-09300	Electrolytic	2
C304,404	4-163T-09400	Electrolytic	2
C326,426, 354,454	4-163T-09500	Electrolytic	4
C701		Electrolytic 3.3μF 50V	1
C923,924, 704		Electrolytic 47μF 16V	3
C702		Electrolytic 220μF 10V	1
C935,936		Electrolytic 100μF 25V	2
C703		Electrolytic 4.7μF 25V	1
C381,481, 391,491, 393,493		Electrolytic 1μF 50V (Nonpolar)	6
C324,424		P P CON 0.015μF ±5% 100V	2
C325,425		P P CON 0.0015μF ±5% 100V	2
C353,453		P P CON 0.0056μF ±5% 100V	2
C321,421, 323,423, 352,452		Mica 10pF b5% 500V	6
C372,472		Mica 10pF ±5% 500V	2
C341,441		Mica 2pF ±5% 500V	2
C303,403		Mylar 0.047μF ±20% 50V	2
C301,401, 302,402, 322,422		Mylar 0.001μF ±5% 50V	6
C351,451, 371,471		Mylar 0.001μF ±5% 50V	4
C929,930, 931,932, 939,940		Ceramic 0.01μF +80—20% 50V	6
C382,482, 392,492		Ceramic 100pF ±10% 50V	4
	RESISTORS		
	All Resistors are Carbon T-type ±5%, ¼W unless otherwise noted.		
R921,922		FP-Carbon 1K ohm ¼W	2
R385,485		FP-Carbon 150 ohm ¼W	2
R341,441		Metal 270K ohm ¼W	2
R362,462		Metal 27K ohm ¼W	2
R330,430, 332,432		Metal 10K ohm ¼W	4
R360,460, 378,478		Metal 7.5K ohm ¼W	4
R309,409		Metal 4.7K ohm ¼W	2
R329,429		Metal 2.7K ohm ¼W	2
R359,459, 361,461		Metal 1.5K ohm ¼W	4
R331,431, 377,477		Metal 1K ohm ¼W	4
R308,408		Metal 33 ohm ¼W	2
R342,442, 346,446		3.3M ohm	4
R333,433, 363,463		1M ohm	4
R322,422		470K ohm	2
R352,452, 372,472, 382,482		100K ohm	6
R392,492, 715		100K ohm	3
R326,426, 356,456, 713		82K ohm	5
R327,427, 357,457		47K ohm	4
R317,417, 334,434, 364,464		33K ohm	6
R704,705, 710		33K ohm	3
R302,402, 311,411, 384,484		10K ohm	6

PARTS LIST

DIGITAL P. C. B. ASS'Y

Key. No.	Part No.	Description	Q'ty
	CAPACITORS		
C89,94,95, 98,99,108, 112,116		Ceramic 0.01μF +80—20% 50V	8
C27,43,47, 48,74,75, 79		Ceramic 0.001μF ±10% 50V	7
C49,76		Ceramic 62pF ±5% 50V	2
C102,106		Electrolytic 0.1μF 50V	2
C105		Electrolytic 0.22μF 50V	1
C3		Electrolytic 1μF 50V	1
C85,86		Electrolytic 2.2μF 50V	2
C67,110,103, 104,107,113		Electrolytic 3.3μF 50V	6
C1,2,4,88		Electrolytic 22μF 16V	4
C26,50,51 80,101		Electrolytic 47μF 50V	5
C109		Electrolytic 100μF 10V	1
C114		Electrolytic 470μF 10V	1
C93		Electrolytic 1000μF 6.3V	1
	RESISTORS All Resistors are Carbon P-type ±5%, ¼W unless otherwise noted.		
R22,50		68 ohm	2
R21		100 ohm	1
R20,39,43, 62		150 ohm	4
R1,2,3,4		180 ohm	4
R5,6,7		180 ohm	3
R59,65,66		470 ohm	3
R52,55		560 ohm	2
R47,48,69		1K ohm	3
R56		1.5K ohm	1
R38,44,58, 60		2.2K ohm	4
R67		2.7K ohm	1
R68		3.3K ohm	1
R34,36,37, 40,54		4.7K ohm	5
R19		6.8K ohm	1
R57		8.2K ohm	1
R15,16,17, 18,63		12K ohm	5
R8,9,10, 11,12		27K ohm	5
R13,14,35, 61		27K ohm	4
R49,64		27K ohm	2
R41		39K ohm	1
R51,53		47K ohm	2
R45,46		68K ohm	2

A/D • D/A P. C. B. ASS'Y

Key. No.	Part No.	Description	Q'ty
60	141-4-250T-42900	P.C.B. Ass'y, A/D, D/A	1
	4-232T-06500	Relay	1
CN9,11	4-236T-19771	Plug, 3p	2
CN12	4-236T-19774	Plug, 6p	1
CN10,13	4-236T-19777	Plug, 9p	2
R31	4-221T-05800	Resistor, 330 ohm ±1%	1
R26	4-221T-05900	Resistor, 2.4K ohm ±1%	1
R30	4-221T-07200	Resistor, 2.7K ohm ±1%	1
R20,25,27	4-221T-06100	Resistor, 10K ohm ±1%	3
R36	4-221T-06200	Resistor, 22K ohm ±1%	1
R48,53	4-221T-07300	Resistor, 2.2K ohm ±1%	2
SVR6	4-220T-04900	Semi-Variable Resistor 100 ohm	1
SVR3	4-220T-04972	Semi-Variable Resistor 220 ohm	1
SVR1,2	4-220T-04985	Semi-Variable Resistor 33K ohm	2
RA1	4-221T-05700	Resistor	1
R23	4-221T-06300	Resistor 1K ohm	1
R24	4-221T-06400	Resistor 3K ohm	1
IC1,2		IC LF398N	2
IC3		IC μPC339C	1
IC4,5,7		IC TC4053BP	3
IC6,8,9		IC LF356N	3
IC10		IC LS3630	1
IC11		IC LM311N	1

A/D • D/A P. C. B. ASS'Y

Key. No.	Part No.	Description	Q'ty
IC15		IC SN74LS157N	1
IC12,13,14		IC SN74LS75N	3
IC16		IC AM2504PC	1
IC17		IC LM310N	1
Q1,5,6		Transistor 2SC536 AUD	3
Q2,3,4		Transistor 2SC930 CONV	3
D2,3,4		Diode DS442 X	3
D5,6,7,8		Diode DS442 X	4
D10,12,13		Diode DS442 X	3
D9		Diode DS442 X	1
D11		Zener Diode GZA6.2Y	1
	CAPACITORS		
C21,22,23, 24,25		Ceramic 200pF ±10% 50V	5
C9,10,11, 12,26		Ceramic 0.01μF +80—20%	5
C27,29,30, 31,14		Ceramic 0.01μF +80—20% 50	5
C 6,8	4-163T-09400	Electrolytic 4.7μF 50V	2
C3,4,13, 15,16		Electrolytic 4.7μF 25V	5
C17,18,19, 20		Electrolytic 4.7μF 25V	4
C1,2		Styrol 1000pF ±5% 50V	2
C28		Mylar 0.012μF ±5% 50V	1
C5,7		Mylar 0.001μF ±5% 50V	2
	RESISTORS		
R11,12		100 ohm	2
R29,35,54		470 ohm	3
R2,4,8, 15,19,22		1K ohm	6
R21		1.5K ohm	1
R28,32		2.2K ohm	2
R34,37,38, 39,47		5.6K ohm	5
R45,46,50		6.8K ohm	3
R6,7,9, 10		10K ohm	4
R13,14,17, 18		10K ohm	4
R5,16,33, 40		15K ohm	4
R42,43,44		15K ohm	3
R41		15K ohm	1
R1,3		1M ohm	2
R51		33 ohm	1

METER P. C. B. ASS'Y

Key. No.	Part No.	Description	Q'ty
61	141-4-250T-43000	P.C.B. Ass'y, Meter	1
	4-985T-02400	Fluorescent Display	1
SVR501, 601	4-220T-04982	Semi-Variable Resistor 10K ohm	2
SVR521	4-220T-04984	Semi-Variable Resistor 22K ohm	1
CN16	4-240T-35500	Socket	1
CN18	4-240T-35600	Socket	1
IC521		IC LC7550	1
IC501		IC NJM3403AD	1
IC502		IC NJM4558DD	1
Q521		Transistor 2SD1012	1
D521		Zener Diode GZA8.2Y	1
D522		Zener Diode GZA11Y	1
D524		Zener Diode GZA4.7Y	1
D501,601, 502,602, 503,603		Diode DS442 X	6
D504,604, 505,605, 506,606		Diode DS442 X	6
D507,607, 508,608, 523		Diode DS442 X	5
D509,609		Diode GMA01	2

PARTS LIST

Key. No.	Part No.	Description	Q'ty
PACKING & ACCESSORIES			
	141-6-133T-41401	Individual Carton	1
	141-6-144T-59900	Foam Plastic Case	2
	141-6-231T-45600	Inner Polye Cover	1
	141-6-410T-85001	Instruction Manual	1
CABINET & CHASSIS			
1	141-0-122T-47101	Front Panel Ass'y	1
2	141-2-111T-40001	Cabinet	1
3	141-2-123T-04040	Side Panel	1
4	141-2-123T-04140	Side Panel	1
5	141-2-125T-30300	Bottom Lid	1
6	141-0-174T-05101	Stand Ass'y	4
7	141-0-156T-33100	Knob Ass'y, Input Level Right	1
8	141-0-156T-33200	Knob Ass'y, Input Level Left	1
9	141-0-156T-33300	Knob Ass'y, Phones Output	1
10	141-2-221T-10700	Bracket Panel	1
11	141-2-315T-26400	Reinforcement, Right Side	1
12	141-2-311T-43500	Chassis	1
13	141-2-119T-02101	Back Panel	1
14	141-0-373T-09000	Bracket Meter Ass'y	1
15	141-2-367T-36600	Bracket Socket, Phones	1
16	141-2-367T-36700	Bracket Socket, MIC (Right & Left)	1
17	141-2-365T-57500	Bracket Switch, Function	1
18	141-2-365T-57600	Bracket Switch, Power Switch	1
19	141-2-367T-36800	Bracket Socket, Connect	1
20	141-2-322T-76800	Shield Plate	1
21	141-0-160T-19700	Push Button Ass'y, Function	5
22	141-2-856T-09900	Spring Coil	5
23	141-2-160T-10500	Push Button, Power Swicth	1
24	141-2-135T-87100	Cover, Power Swicth	1
25	141-2-132T-19700	Sign Window, Power Swicth	1
26	141-2-247T-11000	Sheet, Power Swicth	1
27	141-2-445T-08701	Rubber Cushion	1
28	141-2-322T-76900	Shield Plate	1
29	141-2-135T-87700	Cover	1
30	141-2-411T-08100	Plate Nut	1
31	141-2-210T-17200	Bracket	2
32	141-2-464T-14400	Fixer	1
FIXING PARTS			
Y 1		Binding Hd. Tite Screw 3 x 6mm	6
Y 2		Binding Hd. Screw 3 x 8mm	2
Y 3		Binding Hd. Tite Screw 3 x 6mm	74
Y 4		Binding Hd. Screw 3 x 6mm	4
Y 5		Binding Hd. Tite Screw 3 x 8mm	10
Y 6		Binding Hd. Tite Screw 4 x 6mm	4
Y 7		Binding Hd. Tapping Screw 3 x 10mm	5
Y 8		Flat Hd. Screw 4 x 10mm	12
Y 9		Binding Hd. Tapping Screw 3 x 6mm	15
ELECTRICAL PARTS			
51	4-300T-59600	Power Transformer	1
52	4-243T-84973	Power Cord	1
53	4-238T-13074	Switch, Voltage Selector	1
54	4-612T-14972	Lamp	1
55	4-240T-36800	Socket	1
56	4-240T-36900	Socket	1
57	4-234T-10591	Fuse (FU903)	1
58	4-234T-10587	Fuse (FU901,902)	2
	4-243T-13303	Lead Cord	1
	4-243T-25100	Lead Cord (VTR Connection)	1
	4-243T-25201	Lead Cord (VTR Connection)	1

Key. No.	Part No.	Description	Q'ty
DIGITAL P. C. B. ASS'Y			
59	141-4-250T-42800	P.C.B. Ass'y, Digital	1
CN1,2	4-236T-19777	Plug, 9p	2
CN3,4	4-236T-19774	Plug, 6p	2
CN5	4-236T-21874	Plug, 6p	1
CN6,7,8	4-236T-19700	Plug, 2p	3
RA1	4-221T-07100	Resistor	1
RA2,4	4-221T-05600	Resistor	2
LPF	4-255T-04100	MX Coil	1
L4	4-258T-38900	O S C Coil	1
L3, 6	4-258T-38800	O S C Coil	2
L7	4-252T-06200	Choke Coil	1
L2, 5	4-252T-08628	Choke Coil	2
RA3	4-221T-07400	Resistor	1
X1	4-225T-03700	Crystal	1
X2	4-225T-03600	Crystal	1
X3	4-225T-03800	Crystal	1
IC70		IC HYBRID BX115A	1
IC28,30,60,61,		IC SN74ALS004N	4
IC59		IC SN74ALSO2N	1
IC4, 46,47		IC SN74LSOON	3
IC17		IC SN74LSO2N	1
IC3,24,38, 43,55		IC SN74LSO4N	5
IC34,62		IC SN74ALS74N	2
IC6, 21,36, 51,58		IC SN74LS08N	5
IC12,35		IC SN74LS10N	2
IC44		IC SN74LS11N	1
IC5,7,9		IC SN74LS74AN	3
IC10,13,14,22		IC SN74LS74AN	4
IC25,48,54		IC SN74LS74AN	3
IC11		IC SN74LS86N	1
IC1,2		IC SN74LS123N	2
IC8,39,46		IC SN74LS157N	3
IC26		IC SN74S157N	1
IC19,23,32, 33,63		IC SN74LS161AN	5
IC49		IC SN74LS163AN	1
IC15,18,29		IC SN74LS164N	3
IC37,40,42		IC SN74LS164N	3
IC16		IC SN74LS257N	1
IC56		IC SN74LS393N	1
IC52		IC SN74LS669N	1
IC45		IC TC4001BP	1
IC66		IC TL506CN	1
IC31,65		IC LF357N	2
IC64		IC TL081CP	1
IC20,50		IC TC5516AP	2
IC27		IC μPD785C	1
IC57		IC CX7914	1
IC53		IC TM4505P	1
VD5		Zenner Diode GZA3.9Y	1
VD2,3		Diode 1S2186	2
VD4		Varactor Diode 1SV53 A	1
TR1,2,3,4		Transistor 2SC536 AUD	4
TR5,6,7		Transistor 2SC536 AUD	3
TR8,11,12, 13,14		Transistor 2SC930 CNV	5
	CAPACITORS		
C96		Ceramic 5pF ±0.5pF 50V	1
C82,87,115		Ceramic 27pF ±5% 50V	3
C90		Ceramic 33pF ±5% 50V	1
C97		Ceramic 47pF ±5% 50V	1
C91		Ceramic 56pF ±5% 50V	1
C92,111		Ceramic 100pF ±10% 50V	2
C59,110		Ceramic 150pF ±10% 50V	2
C5,7,9,11		Ceramic 0.01μF +80–20% 50V	4
C13,16,18, 21		Ceramic 0.01μF +80–20% 50V	4
C25,39,41, 42		Ceramic 0.01μF +80–20% 50V	4
C44,45,46, 52		Ceramic 0.01μF +80–20% 50V	4
C53,55,57, 60		Ceramic 0.01μF +80–20% 50V	4
C62,65,69, 72		Ceramic 0.01μF +80–20% 50V	4
C77,78,83, 84		Ceramic 0.01μF +80–20% 50V	4